# REPORT

# 1967

## NORTHEASTERN FOREST EXPERIMENT STATION

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NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPT. AGRICULTURE
6816 Market Street, Upper Darby, Pa. 19082
1968

# A NEW KIND OF REPORT

THIS YEAR we will not publish a comprehensive annual report of the type we have issued in past years. Instead, we have prepared a list of our publications for 1967, along with a brief summary of our major activities and research accomplishments.

We have done this because, as our research program has grown, the cost in effort, time, and money for preparing a comprehensive annual report has become prohibitive. We believe that this new format will save you time, yet will adequately call to your attention any of our published reports that, in these busy times, you might have missed seeing during the past year.

### *Research Programs*

Besides continuing most of the work reported last year in our report, we have modestly strengthened five of our programs: (1) research on management of municipal watersheds, at Upper Darby, Pa.; (2) research on diebacks and declines of hardwoods, at our laboratory at Hamden, Conn.; (3) research on wood products improvement and utilization at our laboratory at Princeton, W. Va.; (4) research on timber harvesting systems in Appalachia, at our laboratory at Morgantown, W. Va.; and (5) our forest survey project at Upper Darby.

At Durham, N. H., we have established a new pioneering research unit. This unit will seek to define the principles that regulate decay and discoloration in living hardwood forest trees and to determine the effects and interactions of organisms in these processes. This basic research, which offers tremendous promise of providing new approaches to preventing infection or lessening its impact, will be under the direction of Dr. Alex L. Shigo.

### *Research Facilities*

Two new laboratories were completed and put into use this year. One is our Forestry Sciences Laboratory at Morgantown, W. Va., which serves research staffs engaged in forest engineering and wildlife habitat; a unit of the Forest Service State and Private Forestry branch is also stationed here. The other is our Forest Insect and Disease Laboratory at Hamden, Conn., which houses the staffs of three insect research projects and one disease research project.

Architectural and engineering plans are practically complete for five other proposed new facilities. These include a Forest Service headquarters building at Radnor, Pa.; and new laboratories at Burlington, Vt., Berea, Ky., and Durham, N. H. Also, funds were appropriated this fiscal year for an addition to our laboratory at Delaware, Ohio, for the use of three projects in insect research and two in disease research, as well as a State and Private Forestry pest-control field unit.

### *Major Accomplishments*

In keeping with our decision to shorten our report, we will not attempt to tell you about all our work. Instead, we will highlight only a few accomplishments as examples, for the benefit of readers who may not be familiar with the range and nature of our work and findings. The reader is referred to the list of publications for our complete record.

- Our Forest Survey is moving steadily ahead on schedule. We have cleaned up our backlog of reports, and all of them are up to date and moving along fast toward publication. We have perfected our automatic data-processing system, have put it to use and have reported on it for the benefit of others who might use it.
- In our recreation research we have focused attention on private campgrounds because they now provide most of the camping facilities in the Northeast. We have identified many of the factors that make for success in private campground enterprises. Now published, this information should be valuable to anyone who operates or wants to begin a campground.

- By collecting and publishing data about pulpwood production in the past several years, we have been able not only to make this information available fairly fast to the people who can use it, but also to establish some trends: pulpwood production almost equals lumber production in the Northeast, and soon may become the primary product of our forests.

- Several of the species in the northern hardwood forest type are shade-tolerant and are well adapted to selection cutting and uneven-aged management. However, there is increasing awareness that timber returns from this type may be greater under some form of even-aged management that will maintain a high proportion of the valuable intolerant and intermediate species. Recent results of a clearcutting study on the Bartlett Experimental Forest substantiate this. After 25 years, a stand on this forest resulting from a clearcutting contains the species composition, stocking, spatial distribution, and growth rate required to produce high-quality hardwoods.

- Today more and more municipal watersheds are being managed for both timber and water production, and our research during the past 2 years adds to the growing evidence that total or partial removal of forest stands will increase the water yield. For example, recent results from our Hubbard Brook Experimental Forest in New Hampshire show an increase of 14 area-inches the first year after clearcutting and eliminating ground vegetation.

- Wooden posts for highway guardrails can now compete again with other materials. Scientists at our Princeton Laboratory helped to develop a small mobile post-driving machine that makes it possible to drive as many as 35 wooden posts per hour. This gives wood a competitive advantage over other materials and makes it possible for wood to recapture part of the guardrail post market and to reduce highway construction costs.

- Our analyses of chip production costs at seven hardwood sawmills showed that investment for debarking and chipping ma-

chines was profitable in every case. Even if the chips—and the pulp and paper industry has a growing need for them—did not return an outright profit, chip production reduced lumber-production costs enough to increase the sawmills' overall profit margin. Our published reports on this should help sawmill operators who in recent years have been caught in a price-cost squeeze that threatens their existence.

- Our marketing researchers developed a quick leveling method for rehabilitating floors, which can be used in urban rehabilitation projects; and in New York City alone, it is estimated, this method might save more than $5 million. In this system, a quick leveling device holds 2-by-2-inch wooden screeds in a level position over old sagging or uneven floors while a quick-hardening urethane foam is sprayed underneath to fill the gaps and bond the screeds to the old floor. The screeds then provide a good base for a new level floor.

- In our efforts to prevent spread of the Dutch elm disease by the European elm bark beetle, we are studying a tiny wasp parasite, imported from France, which feeds on the beetle larvae and kills them. So far we have demonstrated that the parasite can overwinter in several midwestern areas, and can be reared easily in large numbers in the laboratory. We are continuing our work to find out if this and other parasites have practical value for controlling Dutch elm disease.

- A polyhedral virus has been found useful for controlling the European pine sawfly. Now we are seeking to establish whether it can be used safely on a commercial scale. Once this is established, the virus can be registered for general use and this should open the way for registration of other potentially effective viruses that can be used to combat insect pests.

### *Publications*

One chronic problem we have had is to speed the publication of research results, and during the past year we have analyzed our publication process and have adopted some new methods in efforts to solve this problem.

We are also trying to improve our system of publication distribution. Whereas in the past we distributed our publications to a large general mailing list, now we are making a more limited and selective distribution to people who ask for particular items. From this we anticipate a saving in printing costs, and better service to you.

An annotated list of our publications in 1967 follows. Most of the items on this list—either in booklet or reprint form—are available on request. If you want any of these publications, simply write to the Northeastern Forest Experiment Station, 6816 Market Street, Upper Darby, Pa. 19082. In doing so, please indicate clearly the name of the author, the title, the publisher, and the series number if any.

### *A Last Word*

We hope that this brief form of report has saved your time, as it has ours, while still informing you adequately about our research activities and accomplishments. As always, we welcome your advice and comments.

—RICHARD D. LANE
Director

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## PUBLICATIONS


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# 1967 PUBLICATIONS

by staff members and cooperators of
the Northeastern Forest Experiment Station

## GENERAL

Horowitz, Sylvia, and Mary Buchanan.
1967. **Publications of the Northeastern Forest Experiment Station 1950-1965.** U. S. Forest Serv. Res. Paper NE-62. 134 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

An alphabetical list, by authors, of 1,436 publications by staff members of the Northeastern Forest Experiment Station and their cooperators during the period 1950-1965.

Marquis, R. W.
1966. **Wood supply: current and potential.** Amer. Pulpwood Ass. Tech. Paper 65-65: (8.41), in APA Quart. April 1966: 6, 8-10.

Discusses current timber supply and compares future needs for pulpwood to present commercial timber growth.

Northeastern Forest Experiment Station.
1967. **Report 1966.** NE. Forest Exp. Sta. 98 pp., illus. Upper Darby, Pa.

A summary of research activities and accomplishments in timber management, forest insects and diseases, forest economics, watershed management, forest utilization, forest recreation, wildlife habitat, and forest products marketing. Annotated list of publications.

Northeastern Forest Experiment Station.
1967. **Forestry Science Laboratory at Morgantown, West Virginia.** 8 pp. illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A brochure describing the Experiment Station's new research facility at Morgantown, W. Va., and the work being done there in forestry engineering research, wildlife habitat research, and State and Private Forestry.

# TIMBER MANAGEMENT

Anonymous.
1967. **Christmas tree research in the Forest Service.** Amer. Christmas Tree J. 11(1): 47.
Briefly describes the Christmas tree research of the Northeastern Forest Experiment Station's research project at Berea, Kentucky.

Banks, W. G., and H. C. Frayer.
1966. **Rate of forest fire spread and resistance to control in the fuel types of the eastern region.** U. S. Forest Serv. Contr. Notes 27: 10-13.
Studies based on eastern National Forest fire reports indicate that fuel type is not an extremely important factor in the rate of spread during the early period of the fire. Resistance to control, however, differed appreciably by fuel types. The rate of spread increased substantially with increases in the burning index.

Bjorkbom, John C.
1967. **Seedbed preparation methods for paper birch.** U. S. Forest Serv. Res. Paper NE-79. 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
After 5 growing seasons, disking or burning resulted in up to 3 times as much paper birch stocking as no treatment, and up to 6 times as many paper birch seedlings per acre. Where no seedbed preparation was done after logging, the new stands were stocked mainly with advance softwood growth and hardwood sprouts; yet even these stands contained an impressive amount of paper birch regeneration—8 to 12 thousand seedlings per acre. If nearly pure stands of paper birch are desired, a special effort to scarify the soil after logging will be required; otherwise logging alone may be sufficient. In either case, a satisfactory seed source must be present.

Blum, Barton M.
1967. **Plastic tubing for collecting maple sap: a comparison of suspended vented and unvented installations.** U. S. Forest Serv. Res. Paper NE-79. 15 pp., illus. NE Forest Exp. Sta., Upper Darby, Pa.
A large-scale study comparing vented and unvented tubing installations for sugar maple sap collection was conducted during the 1966 maple season. The results indicate that 43 percent greater yields were obtained from the unvented tubing and that the differences in yield were statistically significant. This increase in yield appeared to be related to the presence of vacuum on the unvented tubing installations.

Blum, Barton M., and Melvin R. Koelling.

1967. **Are you tapping deep enough?** Nat. Maple Syrup Dig. 6(2): 16-17, illus.

By local custom, the majority of maple tapholes are drilled to a depth of 3 inches or less—including the thickness of the bark. Since bark thickness varies from ¼ to 1 inch, actual productive depth is often much less than optimum. Allowing for bark thickness and drilling holes to a depth of 3 to 3½ inches in clear wood could increase sap yields by at least 10 percent.

Blum, Barton M., and Dale S. Solomon.

1967. **The accuracy of mean-growth estimates made with dial-gage dendrometers.** U. S. Forest Serv. Res. Note NE-54, 4 pp. illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Instruments that measure growth at only one radius have disadvantages, but the extreme sensitivity of dial-gage dendrometers makes them especially desirable for some purposes. Studies on northern hardwoods provide a guide to the magnitude of variation to be expected, and an approximation of the number of measurements needed to obtain a workable degree of accuracy.

Davenport, O. M., and Russell S. Walters.

1967. **Christmas tree culture in Kentucky.** Ky. Agr. Exp. Sta. Misc. Pub. 346. 55 pp., illus.

In Kentucky few growers now produce high-quality plantation-grown Christmas trees. Many suitable sites are available where farmers and other landowners could, without a large cash investment, convert idle and unproductive land into a source of additional income by planting and raising Christmas trees. The preliminary planning and various cultural practices necessary are described.

Doolittle, Warren T.

1967. **Space-age timber management: silviculture.** Soc. Amer. Foresters New England Sect. News Quart. April 1967: 11-15.

During the space age, foresters will witness accelerated changes and innovations in both wood products and forest land management. The area of forest land available for timber will decline, the importance of other uses — particularly recreation and aesthetics—will increase, and the demand for wood products will also increase, requiring an enlightened multiple-use management. Cultural treatments and silviculture of truly agronomic intensity will evolve on the better lands to meet the demands for certain high-value products. And, increasingly, foresters will have to know the consequences of alternative treatments over a wider range of conditions to meet a wider variety of owner objectives.

Filip, Stanley M.

1967. **Harvesting costs and returns under 4 cutting methods in mature beech-birch-maple stands in New England.** U. S. Forest Serv. Res. Paper NE-87, 14 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Time requirements for logging and products obtained were recorded for initial harvests made by four cutting methods—selection, patch, diameter-limit, and commercial clearcutting. Current average labor and machine rates and product prices were applied to these data to obtain production rates, logging costs, and returns. In each cutting method, dollar returns for multiple products at roadside exceeded production costs.

Gabriel, William J.

1967. **Reproductive behavior in sugar maple; self-compatibility, cross-compatibility, agamospermy, and agamocarpy.** Silvae Genetica 16(5-6): 165-168.

Cross- and self-compatibility, agamospermy, and agamocarpy were studied in native mature trees of sugar maple. Incompatibility systems did not appear to be operating in the trees used in the selfing experiment. Variation in seed-set was not consistently related to the performance of either the male or female parent in trees in the cross-pollination experiment. In the study of agamospermy, none of the seed germinated. The species was found to be highly agamocarpic.

Gabriel, William J., L. Cedric Larsson, and Howard B. Kriebel.

(n.d.). **Hardwood forest tree improvement research in eastern United States and southeastern Canada.** NE. Forest Tree Improve. Conf. committee report. 22 pp.

A summary of information about hardwood tree-improvement projects in the eastern United States and eastern Canada, compiled from answers to questionnaires sent to research organizations. Each listing indicates the status of the project, the species involved, a descriptive title, a statement of objectives, and the name of the agency or organization conducting the research.

Gingrich, Samuel F.

1967. **Measuring and evaluating stocking and stand density in upland hardwood forests in the Central States.** Forest Sci. 13: 38-53, illus.

Stocking and density standards are presented for upland hardwood stands (chiefly oak-hickory and mixed species). The open-grown and forest-grown requirements are used to establish limits of stocking and density for full site utilization. The standards presented are not influenced by site-quality, stand age, or stand structure. The wide distribution of diameters in even-aged upland hardwood stands is due in part to differential species growth. Under most stand conditions of even-aged upland hardwoods, stand structure can be ignored in the appraisal of stocking.

Graber, Raymond E.
1967. **Site preparation for direct seeding conifers.** U. S. Forest Serv. NE. Area State and Private Forestry Direct Seeding Workshop Summary: 8-9, illus. Univ. Mass.

Seedling microsites must be suited to species requirements for successful direct seeding. Retention of light shade from an existing overstory is helpful on the drier sites. Mechanical site-preparation methods give good results, but must be properly used to keep costs down. Fire is effective under only limited conditions. Herbicides do little to alter the seedbed, but may become increasingly important when used in conjunction with other methods.

Graber, Raymond E.
1967. **Post-site treatment of competing vegetation following the establishment of direct-seeded conifers.** U. S. Forest Serv. NE. Area State and Private Forestry Direct Seeding Workshop Summary: 12. Univ. Mass.

Control of competing vegetation after direct seeding is fundamental to successful conifer establishment and growth on most New England sites. Release treatments during the first 10 years encourage rapid seedling development and avoid a long period of suppression and slow growth. These treatments may be accomplished through various selective herbicides. Typical costs for a low-volume area application of 2, 4, 5-T average between $6 and $9 per acre.

Graber, R. E., and D. E. Thompson.
1967. **Mechanized direct seeding—a furrow seeder for rough, stony land.** S. Lumberman 215(2680): 122-123.

An International Harvester 185 beet planter was modified to furrow-seed pine on the moderately steep terrain and stony soil of the Northeast. Initial direct-seeding trials with red and white pine, covering about 45 acres, result in good seed germination and seedling survival. Costs varied from $5 to $10 per acre.

Grisez, T. J.
1967. **Pruning open-grown black cherry.** U. S. Forest Serv. Res. Note NE-57, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Black cherry trees that had large crown ratios and were 4 to 6 inches d.b.h. were pruned to various heights. Epicormic sprouting was severe and diameter growth at breast height was reduced on trees pruned to 75 percent of their height. Most trees pruned to 50 percent show little or no adverse effect after 3 years.

Hamilton, J. R., and G. W. Wendel.
1967. **Specific gravity and fiber length of some hybrid poplars growing in West Virginia.** West Virginia Univ. Agr. Exp. Sta. Bull. 556T, 6 pp.

Describes a cooperative study undertaken by the Northeastern Forest Experiment Station and West Virginia University to determine the fiber length and specific gravity of 50 hybrid poplar clones developed by the Northeastern Station and out-planted in West Virginia as part of a region-wide test in 1951.

Hough, Ashbel F.

1967. **Twenty-five-year results of a red pine provenance study.** Forest Sci. 13: 156-166, illus.

**Pinus resinosa** from 50 different geographic-climatic seed sources ranging from Maine to Minnesota have been studied during a 25-year period in a plantation on the Kane Experimental Forest in northwestern Pennsylvania. Results showed only minor differences in survival and height growth up to 5 years of age, but there were small, significant differences for average total heights at 10, 20, and 25 years. Trees from seed sources from southerly latitudes had better height growth than those from the northerly latitudes. In spite of the statistical differences shown, red pine seed sources within the natural range are relatively uniform in development. For those on the Allegheny plateau who have no local red pine seed source, certain Lake States seed-collection zones with climatic conditions comparable to those of the planting site would be good sources.

Huntzinger, Harold J.

1967. **Seeding black cherry in regeneration cuttings.** U. S. Forest Serv. Res. Note NE-63, 8 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Small seedbeds were established on three newly cutover areas on the Allegheny National Forest. Site preparation, protection from animals, and season of sowing were studied. It was not necessary to prepare the site or to provide protection to obtain good germination. Seedlings exposed to deer browsing were severely limited in height growth. Best growth on the protected seedbeds was obtained on seedbeds that were burned with added fuel.

Koelling, Melvin R.

1967. **A portable field shelter.** U. S. Forest Serv. Res. Note NE-70, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Describes the materials and methods used in constructing a 4 × 8-foot instrument shelter.

Koelling, Melvin R., and Barton M. Blum.

1967. **Controlling taphole depth in maple sap production research.** U. S. Forest Serv. Res. Note NE-61, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Because bark thickness of sugar maple trees varies consider-

ably, the depth of tapholes for collecting maple sap should be varied accordingly to get the taphole depth that will produce the best sap flow. A system of removable collars on the drill bit is recommended as a means of regulating taphole depth in research studies.

Kriebel, H. B., H. C. Larsson, and W. J. Gabriel.
1967. **Report of the NEFTIC Hardwood Improvement Committee.** NE. Forest Tree Improve. Conf. Proc. 14: 76-87.
See Gabriel, Larsson, and Kriebel above.

Little, Elbert L. Jr., Silas Little, and Warren T. Doolittle.
1967. **Natural hybrids among pond, loblolly, and pitch pines.** U. S. Forest Serv. Res. Paper NE-67, 22 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Discusses the ranges of the three pine species in the eastern United States, their growth habits, and distinguishing characteristics; gives botanical descriptions and distribution of the natural hybrids in New Jersey, Delaware, and Maryland; and describes the importance of differentiating the three species and their hybrids in forestry practice.

Little, Silas.
1967. **Japanese honeysuckle: persistent use of herbicides required to combat this robust immigrant.** Brooklyn Bot. Gard. Handbook on Weed Contr. (Plants and Gardens 22(3) ): 62-63, illus.
Countless acres of uncultivated land have been taken over by Japanese honeysuckle. This paper describes, for owners of small properties, the growth of honeysuckle and possible measures of control. Picloram and dicamba are more effective herbicides against honeysuckle than 2,4-D, but they are also more damaging to other vegetation. Small-property owners are advised to use high-volume sprays of 2,4-D and to repeat the application annually if elimination is desired and mechanical measures are not feasible.

Little, S.
1967. **Treatments needed to regenerate yellow-poplar in New Jersey and Maryland.** U. S. Forest Serv. Res. Note NE-58, 8 pp. NE. Forest Exp. Sta., Upper Darby, Pa.
In 17 areas, mostly in the Coastal Plain and Piedmont sections of New Jersey and Maryland, treatments were made to favor the establishment and growth of yellow-poplar reproduction. Results emphasize the importance of fairly large overstory openings (preferably 1 acre or more) and of reductions in understories by mistblowing, burning, or disking, but show that seedbed preparation is needed only in areas borderline because of deep litter, scant seed supply, or dense herbaceous growth.

Little, Silas, and Horace A. Somes.

1967. **Results of herbicide trials to control Japanese honeysuckle.** U. S. Forest Serv. Res. Note NE-62, 8 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Three or more annual sprays are required to eliminate Japanese honeysuckle where 2,4-D, a mixture of 2,4-D and 2,4,5-T, or amitrole is appled as either a low-volume (mist-blower) or high-volume spray. Dicamba and picloram are more effective. The mixture of 2,4-D and picloram is recommended as the best material for eliminating honeysuckle in a single treatment at the time of harvesting overstory trees. However, 3 gallons of the material, costing about $33, are required per acre.

McConkey, Thomas W., and Charles E. Swett.

1967. **Light-weight extension tubes for compressed-air garden sprayers.** U. S. Forest Serv. Res. Note NE-73, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

To hand-spray taller trees safely and efficiently, 8-, 12-, and 16-foot extension tubes for compressed-air garden sprayers were designed and built. These light-weight tubes have been used successfully for spraying white pine leaders for weevil control on the Massabesic Experimental Forest in Maine. Bill of materials and assembly instructions are included.

McQuilkin, William E., and Eugene F. McNamara.

1967. **Tree planting in scrub oak areas after site preparation with heavy equipment.** U. S. Forest Serv. Res. Paper NE-60, 26 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A rootrake technique for preparing sites for planting in rough, stony brushlands is described. By this technique separate patches, each 10 by 15 to 20 feet, are cleared in lines 10 feet apart. At 1956 rental rates for equipment, the cost for such site preparation was about $18 per acre, and the total cost for preparation, trees, and planting labor was about $44 per acre. Trees planted in sites thus prepared in the scrub oak type of the Pennsylvania Poconos have grown well without subsequent release treatments. Red pine and Japanese larch are the most highly recommended species.

McQuilkin, W. E.

1967. **Status of direct seeding in the Northeast.** U. S. Forest Serv. NE. Area State and Private Forestry Direct Seeding Workshop Summary: 1, illus. Univ. Mass.

Brief statement of progress made in direct seedling since 1964. Although no spectacular breakthroughs have occurred, certain seeding procedures on certain kinds of sites can now be considered operational. The basic requirements for success are described.

Marquis, David A.
1967. **Clearcutting in northern hardwoods: results after 30 years.** U. S. Forest Serv. Res. Paper NE-85, 13 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Reproduction resulting from the complete clearcutting of a northern hardwood stand was examined periodically over a 30-year period. Although even-aged, the present stand is a complex mixture of species having different growth rates, maturity ages, and tolerances to shade and competition. This young stand appears to contain the stocking, the spatial distribution, and the growth rate required to produce high-quality hardwoods.

Marquis, David A.
1967. **Soil moisture-soil temperature interrelationships on a sandy-loam soil exposed to full sunlight.** U. S. Forest Serv. Res. Note NE-64, 5 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

In a study of birch regeneration in New Hampshire, soil moisture and temperature were found to be intimately related. Not only does low moisture lead to high temperature, but high temperature undoubtedly accelerates soil drying, setting up a vicious cycle of heating and drying that may prevent seed germination or kill seedlings.

Plass, William T., and Stephen G. Boyce.
1967. **Aesthetic forests for urban areas.** Parks and Recreation 2(10): 42, 73, 90, illus.

An 18-acre research forest of the U. S. Forest Service in Hardin County, Ill., was heavily cut about 1880; yet today the forest has many tall trees of large diameter and is aesthetically pleasing. This example points the way to possibilities for setting aside, managing, and developing forest areas near and within major metropolitan centers.

Roach, B. A.
1967. **Some effects of forest management practices on timber income.** Ky. Governor's Conf. on Forestry Proc. 4: 65-70.

Natural forests, including those previously cut over, seldom yield the maximum of timber and other products of which they are capable. Thinnings and other management practices can reduce the length of time required to grow a given product and increase the proportion of valuable species so that income from forest land ownership is increased. Greater efforts are needed to extend management to a majority of our forested lands to obtain an adequate and regular yield from them.

Roach, Benjamin A., and Samuel F. Gingrich.
1962. **Timber management guide for upland central hardwoods.** U. S. Forest Serv. CS. Forest Exp Sta. and NC. Region, 33 pp., illus.

A 1967 reprint of a guide first published in 1962, recommending silvicultural practices and stocking and management guides for upland central hardwoods in a convenient easy-to-use manner for the practicing forester.

Roach, B. A., and S. F. Gingrich.
1967. **Upland hardwoods can be grown efficiently.** Amer. Pulpwood Ass. 1967 Pulpwood Annu.: 85-87.
Describes the general pattern of silviculture for upland hardwoods and provides some management recommendations for hardwood pulpwood. Estimated costs and yields for pulpwood production in unmanaged stands are compared with similar costs and yields under several thinning regimes. Thinning is shown to increase yields considerably; calculated estimates of maximum investment in precommercial thinning are given. Some future problems that will face producers of hardwood pulpwood are discussed.

Sander, Ivan L.
1967. **Composition and distribution of hardwood reproduction after harvest cutting.** 1966 Symp. on Hardwoods of the Piedmont and Coastal Plain Proc.: 30-33, illus. (Ga. Forest Res. Council.)
Natural reproduction in upland hardwood stands is usually adequate regardless of how the stand is cut, but the cutting method influences composition and development of the new stand. Oaks that survive in the new stand are stump sprouts and new sprouts that came up from advance reproduction present under the old stand. Yellow-poplar reproduction consists of new seedlings that develop from seed stored in the litter. Clearcutting resulted in more new oak sprouts and more and better-distributed yellow-poplar reproduction than selection, shelterwood, or heavy improvement cutting.

Santamour, Frank S. Jr.
1967. **Growth and characteristics of some hybrid spruces.** Univ. Pa. Morris Arboretum Bull. 18(1): 18-20.
Height growth data for 9-year-old interspecific hybrids of spruce outplanted at the Morris Arboretum. Results suggest that there is little to be gained in growth rate by interspecific hybridization. Superior trees and stands of **Picea abies** and **P. glauca** should provide fully adequate planting stock for the forests of the Northeast. Some of the hybrids may have desirable horticultural characteristics.

Schreiner, Ernst J.
1967. **Physiological and biochemical research on asexual reproduction in forest trees: an essential approach to early maximum genetic improvement.** 14th IUFRO Congr. Papers 3 Sect. 22: 224-247. Munich.
Early and maximum genetic improvement of forest trees can be achieved and maintained only through clonal progagation.

There is need for greatly expanded physiological, biochemical, and cytological research on the induction of asexual reproduction to make superior genotypes available as clones. Current knowledge of an ability to induce vegetative reproduction and agamospermy is reviewed and discussed.

Schreiner, Ernst J.

1967. **Origins, objectives, and membership of NEFTIC.** NE. Forest Tree Improve. Conf. Proc. 14: 3.

The Northeastern Forest Tree Improvement Conference is a gathering of research workers, practicing foresters, forest owners, and representatives of wood-using industries who are interested in better trees for our forests. The first conference was held in 1953 and annual meetings since then provide for the exchange of information on tree improvement.

Schreiner, Ernst J.

1967. **Guidelines for selecting and producing genetically better trees for street and park planting.** N. J. Federation Shade Tree Comns. Annu. Meeting Proc. 1966: 38-43.

Describes the basis for genetic improvement in plants, the role of vegetative propagation, the danger of monoclonal cultures, and the possibilities of maximum genetic improvement through synthetic multiclonal hybrid varieties. Some guidelines for selecting and producing genetically better amenity trees.

Smith, H. Clay

1967. **Epicormic branching on eight species of Appalachian hardwoods.** U. S. Forest Serv. Res. Note NE-53, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study to evaluate bole sprouting of eight hardwood species. White oak was most susceptible to bole sprouting; white ash was least susceptible. On the average, more sprouts develop on second logs than on first logs; and more sprouts develop on intermediate and overtopped trees than on dominant and codominant ones.

Smith, H. Clay

1967. **Visible dormant buds as related to tree diameter and log position.** U. S. Forest Serv. Res. Note NE-56. 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Red oaks and yellow-poplars in a stand of second-growth cove hardwoods in West Virginia were studied to determine whether visible dormant buds are related to tree size or log position. No correlation was found between dormant buds and tree size, for either species; but yellow-poplars had a significantly greater number of buds on the upper log.

Solomon, Dale S., and Barton M. Blum.

1967. **Stump sprouting of four northern hardwoods.** U. S. Forest Serv. Res. Paper NE-59, 13 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

To aid timber and wildlife managers, relationships between stump sprouting and characteristics of the stump and surrounding stand were investigated for red maple, sugar maple, paper birch, and yellow birch. Prediction equations indicated that small stumps of red maple (the most prolific sprouter) and sugar maple generally produced more sprouts than larger stumps. The smaller sugar maple stumps and younger red maple stumps produced taller sprouts. Relationships for paper birch were inconclusive; and yellow birch proved to be essentially a non-sprouting species.

Trimble, George R. Jr.

1967. **Diameter increase in second-growth Appalachian hardwood stands—A comparison of species.** U. S. Forest Serv. Res. Note NE-75, 5 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A study of growth at d.b.h. among eight hardwood species after partial cutting in second-growth stands. Red oak grew fastest, followed in order by yellow-poplar, sugar maple, basswood, black cherry, white ash, beech, and chestnut oak.

Trimble, G. R. Jr., and E. H. Tryon.

1967. **Seeding characteristics of eleven Appalachian hardwood species.** NE. Forest Exp. Sta., Upper Darby, Pa. 20 pp.

Presents tabulated data on the seeding characteristics of eleven hardwood species. The data, obtained from review of published literature and from previously unpublished information obtained from selected forest scientists, should be useful in the natural or artificial regeneration of Appalachian hardwoods.

Van Buijtenen, J. P.

1967. **Quality control begins in the woods.** Forest Biol. Conf. Proc. 4: 102-110. Points Claire, Quebec, Canada.

A qualitative understanding of the relationships between wood properties and pulp properties has been achieved. With this knowledge, we can begin to apply a number of forest-management practices and breeding methods that will alter wood properties and thus allow some control to be exercised over the quality of the raw materials reaching the pulpmill. The relationships involved are complex, making it highly desirable to undertake a systematic evaluation of the various means of controlling wood quality. A number of approaches are discussed.

Van Buijtenen, J. P.
1967. **Pulpwood properties and tree breeding, a synthesis.** 14th IUFRO Congr. Papers 9 Sect. 41: 244-262. Munich.

The literature relating wood properties to pulp yield and pulp quality is reviewed and discussed. Because of complex interrelationships among the various tree properties, breeding for pulpwood production is complicated. A selection index approach is suggested in which each trait is weighted for its proper evaluation as a breeding criterion. Investment-return analyses help to evaluate the most effective tree-improvement programs.

Van Buijtenen, J. P., and K. Stern.
1967. **Marginal populations and provenance research.** 14th IUFRO Congr. Papers 3 Sect. 22: 319-331.

Marginal populations of forest trees include both isolated populations outside the continuous range and non-isolated populations near the border of a more or less continuous species range. Extremely divergent ecotypes are expected in isolated populations resulting from severe selection, which often gives rise to evolution of new coadapted gene-complexes. In non-isolated populations, the interplay of selection and migration, as well as the number of generations since immigration, are expected to determine the amount of genetic variation. Traditional methods of provenance research do not suffice for marginal populations.

Walters, Russell S.
1967. **Marketing other products of the forest.** Ky. Governor's Conf. on Forestry Proc. 1967: 53-59, illus.

The forests of the Appalachian region are rich in useful and valuable plants other than timber-producing trees. The culture, harvesting, and marketing of christmas trees, medicinal plants, decorative plants, and edible plants is described and the possible development of these timber-related industries in Kentucky is discussed.

Walters, Russell S.
1967. **Other products of the Forest.** Ohio Woodlands 6(1): 17-18.

See above.

Walters, Russell S.
1967. **Straight talk about Christmas tree planting.** Amer. Christmas Tree J. 11(1): 24-25, illus.

Even experienced tree planters sometimes carelessly set a few seedlings in a leaning position. This results in lower quality and cull trees with crooked stems. A survey of a 1-year-old plantation showed nearly 12 percent of the trees had been planted in a leaning position. This could represent a significant

loss of income and should be avoided by thorough training and adequate supervision of tree planters.

Wendel, George M.

1967. **Seedbed scarification from horse skidding during clearcutting.** N. Logger 15(8): 12, 27, illus.

In a survey of recently clearcut hardwood areas, it was found that horse skidding resulted in exposed mineral soil on 25 percent of the area while 19 percent of the area was left in a mixture of humus and litter and 56 percent of the area was undisturbed. Partial conversion to white pine could probably be obtained on these sites through direct seeding; however, more intensive site preparation is probably needed for complete conversion.

Weigle, Weldon K.

1967. **Spoil bank stability in eastern Kentucky.** Mining Congr. J. April 1966: 4 pp., illus.

A study of 17 slides in four eastern Kentucky counties to determine how wide spoil-bank fill terraces can be built in steep terrain without danger of slides. Shows that relatively stable spoil banks can be insured by control of fill-bench widths.

# WATERSHED MANAGEMENT

Corbett, Edward S.

1967. **Measurement and estimation of precipitation on experimental watersheds.** Int. Symp. Forest Hydrol.: 107-129, illus. Pergamon Press, Oxford, England.

The literature pertinent to the measurement of precipitation (primarily rainfall) on watersheds is reviewed, including types of rain gages, accuracy of point rainfall measurements, selection of rain-gage sites, precipitation variability and its effects on rain-gage network designs, and extrapolation of point precipitation values to areal estimates.

Curtis, Willie R.

1967. **Hydrology.** Ky. Dep. Natur. Resources Strip Mining Symp. Proc. 3 pp.

Strip-mining drastically alters the hydrology of the immediate area, and the influence may be felt many miles downstream. Surface runoff is increased. Storage space within the spoil may result in increased low flows. Erosion and sedimentation are increased, and slides may occur. Acid mine water is a major problem. Studies are being designed and installed to provide information necessary to meet the problem on two watersheds in Breathitt County, Ky.

Curtis, Willie R.

1967. **Simple practices along forest edge reduce upland runoff.** Soil and Water Conserv. 22: 25-26, illus.

Wooded slopes in the Driftless Area of Iowa, Minnesota, and Wisconsin protect lower agricultural lands from surface runoff. The degree of protection can be increased by placing logs in a staggered arrangement along the slope and by installation of small detention ponds. Construction of detention ponds was more effective and less expensive than cutting and scattering logs.

Davis, Grant.

1967. **Hydrology of contour strip mines in the Appalachian region of the United States.** 14th IUFRO Congr. Papers Sect. 11: 420-443, illus.

Coal beds underlie about 50,000 square miles, or 30 percent, of the Appalachian Mountains; and almost a million acres have been strip-mined. Spoils are composed primarily of shattered pieces of the rock strata that originally lay above the coal seams; sulfides are mixed throughout. Upon exposure, sulfuric acid and metallic sulfates are formed. Stormflow, sediment load, and water quality of streams in a watershed may be affected profoundly.

Davis, Grant.

1967. **Revegetation.** Ky. Dep. Natur. Resources Strip Mining Symp. Proc. 3 pp.

Spoil banks are revegetated to provide a green cover, stabilize the soil, and produce useful products. New soil-testing procedures have been developed. Possible plant species are screened in the greenhouse; the more promising ones are then used in field trials. Treatment with lime, fertilizers, and mulches, as well as furrowing and terracing, are being investigated. The team approach in revegetation research is a necessity because engineering, soils, ecology, and other aspects are interrelated.

Federer, C. Anthony.

1967. **New radiation instruments.** Int. Symp. Forest Hydrol. Proc.: 801-805. Pergamon Press, Oxford, England.

Several new designs of polyethylene-shielded radiometers offer forest hydrologists a wide selection of instruments for measuring net radiation. One of these is capable of measuring separately all four radiation flux components. Silicon solar cells offer an inexpensive but fairly accurate method of measuring incoming solar radiation. An infrared thermometer for measuring surface temperature and a spectroradiometer for measuring the spectral distribution of light are useful new instruments.

Hart, George E.

1967. **New stream-gaging instruments.** Int. Symp. Forest Hydrol, Proc.: 787-790. Pergamon Press, Oxford, England.

Conditions characteristic of stream-gaging stations in forest hydrology are reviewed. A major development is the analog-to-digital recorder that makes possible fully automated processing of discharge data. A combined hydrograph and rainfall recorder has been developed recently but performance reports are not yet available. The new bubble gage, in which gas pressure corresponds to depth of water, can be used to avoid expensive stilling-well construction. Newly-developed fluorescent dies and fluorescence-measuring devices hold promise for application of the dilution method to obtain short-term records and for use at hard-to-reach sites.

Hornbeck, James.

1967. **Clear cutting and the erosion hazard.** N. Logger 16(4): 14, 15, 38, 39, 48, illus.

Soil erosion and stream turbidity are more closely related to logging-road standards than to the volume of timber cut; this was demonstrated when vegetation was almost completely removed from two research areas on the Fernow Experimental Forest in West Virginia.

Lane, Richard D.

1967. **Cooperative strip mine research.** Ky. Dep. Natur. Resources Strip Mining Symp. Proc. 2 pp.

Forest Service reclamation research began in Ohio in 1937. Through the 40's and 50's research was continued in midwestern coal fields and in Pennsylvania. Initial efforts were limited to establishing tree cover. The program has been broadened in recent years to include the Appalachian coal field and all primary forest resources—timber, water, wildlife, recreation, and forage. Cooperation has been the principal theme; and federal and state agencies, universities, and industry have participated.

Leaf, Albert L., and Raymond E. Leonard.

1967. **Measurement of environmental characteristics of a forest stand.** 14th IUFRO Congr. Sect. 21: 282-297.

Describes forest treatment-environment studies of a red pine plantation on a sandy outwash plain located on the Pack Forest in the Adirondacks. Results of fertilizer application are described along with measurements of water table, soil characteristics, microclimate, and vegetation.

Leaf, Albert L., and Raymond E. Leonard.

1967. **Forest fertilization, irrigation, and environment.** S. Lumberman 215(2680): 163-165, illus.

Describes forest treatment-environment research on a red pine

plantation growing on an outwash sand plain on the Pack Forest in the Adirondack Mountains. Study includes application of fertilizer and measurement of many aspects of vegetation, microclimate, soils, and water availability.

Leonard, Raymond E.
1967. **Mathematical theory of interception.** Int. Symp. Forest Hydrol, Proc.: 131-136, illus. Pergamon Press, Oxford, England.

Moisture stored on vegetation and evaporation from vegetation during a storm period are significant items in the precipitation budget. Water storage of a leaf depends on leaf area and surface tension. Surface tension in turn is affected by leaf surface configuration, liquid viscosity, and mechanical activity. Total canopy storage is a function of leaf area, surface tension ratio, storm intensity, and storm size. Mathematical equations for the rainfall-interception process are presented and discussed; the exponential curve appears to fit best.

Likens, G. E., F. H. Bormann, N. M. Johnson, and R. S. Pierce.
1967. **The calcium, magnesium, potassium and sodium budgets for a small forested ecosystem.** Ecol. 48: 772-785, illus.

Six watersheds on Hubbard Brook Experimental Forest in New Hampshire, characterized by a near-climax northern hardwoods ecosystem, were studied. Cation analyses were made by atomic absorption spectrophotometry and estimates were made for gains and losses in precipitation, dry fallout, and streamflow. These provided an estimate of geochemical weathering in the system.

Lull, Howard W.
1967. **How our cities meet their water needs. In Outdoors USA,** U. S. Dep. Agr. Yearbook 1967: 104-109, illus.

In the Northeast, 400 municipal watersheds with more than a million acres of forest supply about a third of the region's 50 million people. In the West, over 40 million acres of national forest are used as municipal watersheds to serve directly over 17 million people in almost 1,100 communities. Today, more and more municipal watersheds are being managed for their timber. With care, trees can be harvested without damaging water quality. Besides providing revenue, logging may increase water yields. Snow management also provides possibilities for increasing yield.

Lull, Howard W.
1967. **Factors influencing water production from forested watersheds.** Univ. Mass. Coop. Ext. Serv. Pub. 446: 2-7, illus. (Municipal Watershed Management Symp. Proc. 1965.)

Interception, infiltration, storage, and evapotranspiration affect water production. For southern New England, hardwoods may

intercept about 5 inches and pines about 9 inches of an annual precipitation of 45 inches. The forest effect on water storage lies principally in the organic layer that may store a fraction of an inch to 2 inches. Evapotranspiration from forest cover is probably greater than from any other kind of vegetation. Reduction of evapotranspiration can increase water production.

Lull, Howard W.

1965. **Techniques of regional analysis of watersheds by physiographic regions. In** U. S. Forest Serv. Work Conf. on Analysis of Hydrol. Data. 16 pp., illus.

Seventeen-year records of daily discharge of 137 watersheds in the Northeast are being analyzed with computer help. Differences in annual and seasonal flows among physiographic regions and among watersheds within regions were highly significant. Spring runoff increases and summer runoff decreases with more northern latitude and greater elevation. Maximum daily discharges were significantly different among regions, as were the maximums among watersheds within five of the seven regions studied. There was considerable agreement in annual and seasonal runoff between regional values and values for five small experimental watersheds.

Lull, Howard W., and Henry W. Anderson.

1967. **Important watershed characteristics affecting water yield, flood peaks, and erosion and sedimentation and the basic data needed for prediction.** Int. Conf. on Water for Peace. Proc. 1967: 1-8.

The amount of flow and sediment in a stream are both a result and an indicator of upstream conditions, past and present. Evapotranspiration is fairly constant, leaving precipitation variation responsible for most variation in runoff. Water yields from accumulated snowpacks have been the easiest to predict. Effects of changes in land use on yield have been demonstrated. The dominant watershed factor in flood-forecasting of rivers is channel storage; physical and biological characteristics of small watersheds principally influence their peaks. Sediment discharge depends on erosion from slopes and channels and the transport of eroded materials. Prediction concepts and analytical procedures are presented.

Lull, Howard W., and Irvin C. Reigner.

1967. **Radiation measurements by various instruments in the open and in the forest.** U. S. Forest Serv. Res. Paper NE-84, 21 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Shortwave, longwave, and net radiation and visible light were measured beneath hardwood and pine canopies and in the open on 33 days over a period of 1 year. Shortwave measurements by different instruments are compared; the daily disposition of radiation at the three sites is given; and the radiation on clear and cloudy days is discussed.

Lull, Howard W., and Kenneth G. Reinhart.

1967. **Increasing water yield in the Northeast by management of forested watersheds.** U. S. Forest Serv. Res. Paper NE-66, 45 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Possibilities of increasing water yield from forested watersheds by total and partial forest removal are described in relation to methods, effectiveness, and costs. Reductions in water yield from reforestation and long-term forest protection are also discussed. Necessary precautions and safeguards for production of high-quality water from treated watersheds are listed.

Lull, Howard W., and William E. Sopper.

1963. **Characteristics of streamflow from small watersheds in the Northeast.** Soil Conserv. Serv. Hydraulic Eng. Meeting Aug. 1963. 19 pp., illus.

A cooperative research program of the U. S. Forest Service and the Pennsylvania State University is determining characteristics of annual and seasonal runoff, flow duration and storm flows for 137 watersheds having areas less than 100 miles. Characteristics are related to physiographic regions, geographic, topographic, climatic, and other physical features, and to characteristics of small experimental watersheds.

Lull, Howard W., and William E. Sopper.

1967. **Prediction of average annual and seasonal streamflow of physiographic units in the Northeast.** Int. Symp. Forest Hydrol. Proc.: 507-522, illus. Pergamon Press, Oxford, England.

An analysis of data from 137 watersheds in the Northeast with areas of less than 100 square miles showed significant differences in average annual and seasonal runoff among 7 major physiographic units. Average annual and seasonal runoff among watersheds within units were also significantly different, and they were also significantly different among watersheds clustered within a 30-mile radius. Reasons for differences are discussed.

McQuilkin, W. E.

1967. **Comment on Schramm's studies of plant colonization on black anthracite mine wastes in Pennsylvania.** Pa. Forests: 57(1): 16-17.

A review of J. R. Schramm's book "Plant colonization studies on black wastes from anthracite mining in Pennsylvania". (Published by American Philosophical Society.) Discusses Schramm's findings that lethal temperatures at the spoil surface and acute nitrogen deficiency are the primary reasons that plants do not become established naturally on spoils.

May, Robert F., and W. David Striffler.

1967. **Watershed aspects of stabilization and restoration of strip-mined areas.** Int. Symp. Forest Hydrol, Proc.: 663-671, illus. Pergamon Press, Oxford, England.

Mountain watersheds strip-mined for coal undergo mechanical and hydrologic changes; both stormflows and low flows are affected. Erosion and sedimentation result from slides from sidecast overburden, haul roads, and the mined area itself; chemical water quality is also affected. Disturbance can be minimized by proper mining methods. Revegetation by herbaceous and tree species is necessary for erosion control and a return to productive use.

Pierce, Robert S.

1967. **Evidence of overland flow on forest watersheds.** Int. Symp. Forest Hydrol. Proc.: 247-253, illus. Pergamon Press, Oxford, England.

Forest lands in general have optimum infiltration and negligible overland flow. Fire, trampling and compacting, and logging may initiate overland flow. A summer storm hydrograph from a small forested mountain watershed is presented. Hydrograph analysis indicates overland flow that would not be expected considering watershed conditions. Perhaps it occurred over accumulated leaf debris, laterally at interface of humus and mineral soil, or laterally through the uppermost porous mineral layer. In forest hydrology research, a closer examination of water disposal on the forest floor may be necessary.

Pierce, Robert S.

1967. **Water-quality problems related to timber culture and harvesting.** Univ. Mass. Coop. Ext. Serv. Pub 446: 45-48. (Municipal Watershed Management Symp. Proc. 1965.)

More and more watershed lands are now being managed for multiple use. Careless logging can result in high stream turbidities: up to 7,000 parts per million in one study and 56,000 p.p.m. in another. However, these and other studies show that timber can be harvested without impairing water quality. Other studies show that phenoxy herbicides can be used in stand treatment without damage to water. Effects of harvesting on water temperature and dissolved nutrients are also discussed.

Plass, William T.

1967. **Land disturbances from strip-mining in eastern Kentucky.** 2. Princess Coal Reserve District. U. S. Forest Serv. Res. Note NE-55, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results of an airphoto survey to determine the extent of land disturbance by coal mining and by coal-haul roads in one of the six coal-reserve districts of eastern Kentucky. Describes the district, forest cover, physiography and geology, and distribution and physical characteristics of the areas disturbed in this district.

Plass, William T.
1967. **Land disturbances from strip-mining in eastern Kentucky.** 3. Licking River Coal Reserve District. U. S. Forest Serv. Res. Note NE-68, 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results of an airphoto survey to determine the extent of land disturbance by coal mining and by coal-haul roads in one of the six coal-reserve districts of eastern Kentucky. Describes the district, forest cover, physiography and geology, and distribution and physical characteristics of the 1,456 acres disturbed in this 1.1 million-acre district.

Plass, William T.
1967. **Land disturbances from strip-mining in eastern Kentucky.** 4. Big Sandy Coal Reserve District. U. S. Forest Serv. Res. Note NE-69, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results of an airphoto survey to determine the extent of land disturbance by coal mining and by coal-haul roads in one of the six coal-reserve districts of eastern Kentucky. Describes the district, forest cover, physiology and geology, and distribution and physical characteristics of the areas disturbed in this district.

Plass, William T.
1967. **Land disturbances from strip-mining in eastern Kentucky.** 5. Hazard Coal Reserve District. U. S. Forest Res. Note NE-71, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results of an airphoto survey to determine the extent of land disturbance by coal mining and by coal-haul roads in one of the six coal-reserve districts of eastern Kentucky. Describes the district, forest cover, physiography and geology, and distribution and physical characteristics of the areas disturbed in this district.

Plass, William T.
1967. **Land disturbances from strip-mining in eastern Kentucky.** 6. Southwestern Coal Reserve District. U. S. Forest Serv. Res. Note NE-72, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results of an airphoto survey to determine the extent of land disturbance by coal mining and by coal-haul roads in one of the six coal-reserve districts of eastern Kentucky. Describes the district, forest cover, physiography, and geology, and distribution and physical characteristics of the areas disturbed in this district.

Plass, William T.
1967. **Survey of eastern Kentucky.** Ky. Dep. Natur. Resources Strip Mining Symp. Proc. 6 pp.

Gives details of a 1964 Forest Service survey of area disturbed by strip-mining in eastern Kentucky. No disturbance was found in 6 counties; in 13 other counties the disturbance was less than 500 acres per county. Eight counties showed moderate disturbance totaling 13 thousand acres. The remaining eight counties showed a total of 40 thousand acres disturbed. The highwall accounts for 11 percent of all disturbance; the bench, 44 percent; and the outslope, 45 percent.

Plass, William T., and James D. Burton.

1967. **Pulpwood production potential on strip-mined land in the South.** J. Soil and Water Conserv. 22: 235-238, illus.

Wherever extensive areas of strip-mined lands lie within a pulpmill procurement area, an opportunity exists for a cooperative reclamation program. Pine growth on spoil will be slower than on good natural sites but may equal or exceed that on eroded abandoned farmland. On one spoil-bank in Alabama, 20 cords per acre were produced in 20 years. The condition, size, geographical location, and site quality of stripped areas must be considered before attempting management for pulpwood.

Plass, William T.

1967. **Review** of Plant colonization studies on black waste from anthracite mining in Pennsylvania, by J. R. Schramm in Amer. Philosophical Soc. Trans. J. Forestry 64: 820.

Schramm's paper is an outstanding treatise on establishment of vegetation on mining wastes, based on observation and experimentation over a period of 20 years. Moisture, waste reaction, wind, frost heaving, temperature, and root symbiosis are among the subjects discussed.

Reigner, Irvin C.

1967. **Summary of discussions on new instruments.** Int. Symp. Forest Hydrol. Proc.: Pergamon Press, Oxford, England.

Reviews instruments described at the Symposium. Precipitation measurement was not discussed but three new instruments have appeared. The greatest need for instrumentation improvement is in the measurement of erosion.

Reigner, Irvin C.

1967. **Effect of recreation on water quality.** Univ. Mass. Coop. Ext. Serv. Pub. 446: 49-55. (Municipal Watershed Management Symp. Proc. 1965.)

Public pressure to use watershed lands for recreation has been increasing. New England experience has been discouraging, not

necessarily because of water contamination but primarily because of vandalism, littering, and obvious unsanitary practices. San Diego has allowed recreation on watershed lands and has found no evidence of contamination; this may be because San Diego completely treats its water. Fishing and boating are allowed on many watershed areas. Hunting, **per se,** should have little effect but is most often prohibited. Picnicking, hiking, and birdwatching are usually allowed; swimming and camping are usually prohibited. The water supply administrator must have control over all recreation on the watershed.

Reigner, Irvin C., and Louis G. Ningard.
1967. **Baltimore's watersheds: an example of integrated land use.** J. Amer. Water Works Ass. 59: 1469-1477, illus.
The Baltimore watersheds, besides supplying the city with water, produce timber and provide jobs; the greatest pressure is to provide recreation. Baltimore owns 17,300 acres around three reservoirs. The sedimentation rate from 1943-61 was less than one-third of the rate before 1943. A forester supervises road layout, construction and maintenance, and other measures to protect water quality. Since 1946 controlled fishing and rowboating, golfing, bow-hunting, and picnicking have been allowed. Forest research is also conducted on the watershed.

Reinhart, Kenneth G.
1967. **Watershed calibration methods.** Int. Symp. Forest Hydrol, Proc.: 715-723, illus. Pergamon Press, Oxford, England.
Watersheds are calibrated to relate various characteristics—annual or seasonal flow, flood flows, low flows, and water quality—to various parameters considered useful for prediction. The most common and usually the most successful approach is to relate flow of one watershed to that of another, the control. Where a control watershed is not available, climatic parameters are selected. More efficient procedures are needed to attain more accurate prediction and to evaluate treatments with slight impact.

Reinhart, K. G.
1967. **Increasing water production through manipulation of vegetation.** Univ. Mass. Coop. Ext. Serv. Pub. 446: 17-26, illus. (Municipal Watershed Management Symp. Proc. 1965.)
Vegetation management can increase annual water yields by reducing summer transpiration, evaporation from snow, or both. Opportunities are greatest in areas of ample and well-distributed precipitation, but some yield improvement may be possible in drier areas. Any application of present knowledge should be made with caution.

Reinhart, K. G., A. R. Eschner, and G. R. Trimble Jr.
(n.d.) **Effect on streamflow of four forest practices in the Mountains of West Virginia.** (In Japanese.) 52 pp., illus. Miyagi Prefecture Forest Conservation Cooperative Association, Japan.
A reprinting of U. S. Forest Service Research Paper NE-1 (1963), describing increases in annual flow resulting from different intensities of cutting on calibrated watersheds. Translated and published for benefit of Japanese research officers and field men, as a result of visit by Kenji Odame to the Fernow Experimental Forest in 1963.

Sopper, William E., and Howard W. Lull.
1967. **An evaluation of streamflow timing from small watersheds in northeastern United States.** 14th IUFRO Congr. Papers Sect. 11: 281-297, illus. Munich.
Daily streamflow records for 17 years from 134 watersheds of less than 100 square miles area were analyzed to determine periods of time required to produce one-quarter and one-half of the annual flow (high-flow intervals) and 1 and 5 percent of the annual flow (low-flow intervals). Differences in beginning dates of high-flow intervals among physiographic regions were highly significant. Variables most highly correlated with high- and low-flow intervals were latitude, temperature, evaluation, relief, and percent of the watershed in forest cover.

Sopper, William E., and Howard W. Lull (Editors).
1967. **International Symposium on forest hydrology.** 813 pp., illus. Pergamon Press, Oxford, England.
Proceedings of a National Science Foundation Advanced Science Seminar held at the Pennsylvania State University in 1965. An up-to-date picture of forest hydrology is presented in more than 80 papers: country-by-country resumes of forest hydrology research, forests and precipitation, forests and soil water, forests and evapotranspiration, forests and runoff, forests and soil stabilization, and research techniques and instrumentation.

Striffler, W. David.
1967. **Restoration of open-cast coal sites in Great Britain.** J. Soil and Water Conserv. 22: 101-103, illus.
Open-cast mining in Great Britain is similar to strip-mining in the United States. Mined area is easier to reclaim because of less acid formation, smaller areas, abundant rainfall, and a nationalized, noncompetitive industry. Restoration is both more extensive and more intensive than in the United States.

Van Dyne, G. M., and W. G. Vogel.
1967. **Relation of** Selaginella densa **to site, grazing, and climate.** Ecol. 48: 438-444.
Small clubmoss grows on shallow, rocky, or gravelly sites in

central Montana foothills. Cover by this species is reduced by high levels of fertility, shading, and mulch; cover is increased where additional water is available. Decrease in cover resulted from intensive grazing.

Whipkey, Ronald Z.

1967. **Theory and mechanics of subsurface stormflow.** Int. Symp. Forest Hydrol. Proc.: 255-260. Pergamon Press, Oxford, England.

Subsurface stormflow is a major component of total stormflow from forested drainages. The direct applicability of Darcy's law and other existing equations is doubtful. Derivation of a field equation with a range of constants for varying physiographic conditions will be required. Research on subsurface stormflow should investigate the basic laws, the effects of soil characteristics and roots, simulation of subsurface flow by laboratory model or computer, and methods of fracturing impeding layers to promote groundwater recharge.

Williams, George P.

1967. **Roads, slides, and check dams.** Ky. Dep. Natur. Resources Strip Mining Symp. Proc. 4 pp.

Engineering on a strip-mine operation should result in economical haul roads not harmful to the watershed, outslopes planned for coal production yet stable and suitable for revegetation, and streams protected by devices engineered for economy and effectiveness.

# FOREST ECONOMICS

Callahan, John C.

1966. **Economic returns associated with fifty nonindustrial private woodlands.** Purdue Univ. Res. Bull. 815. 16 pp., illus.

Analysis of data from 50 private woodlands, covering 5 to 17 years, showed an average 5-percent internal rate of return, a net dollar return of $7 per acre per year. Nearly a third of these woodlands had rates of return over 6 percent.

Chapelle, D. E.

1967. **Financial maturity of eastern white pine in New York State.** N. Y. State Univ. Coll. Forestry Syracuse, Tech. Pub. 91. 261 pp.

A model of financial maturity was developed and used to evaluate individual white pine trees for cutting in a thinning operation. Analysis of financial maturity is examined from the viewpoint of four types of timber-growing firms whose objectives are to maximize net revenue per unit of time.

Ferguson, Roland H.

1967. **The timber resources of Maryland.** U. S. Forest Serv. Resource Bull. NE-7, 93 pp., illus. NE Forest Exp. Sta., Upper Darby, Pa.

A report on a resurvey 14 years after the initial forest survey made by the U. S. Forest Service, presenting statistical findings on forestland area, timber volume, net annual growth, and timber cut, and describing changes and trends in the timber resource. Presents an outlook on the timber supply and management opportunities. Report contains 65 tables of statistical data, including forest areas and timber volume for counties.

Frayer, Warren E.

1967. **A systematic bias in the interpretation of CFI results.** U. S. Forest Serv. Res. Note NE-60, 4 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

It is not generally recognized that a serious bias arises in the estimates of annual ingrowth and accretion, two of the growth components available from continuous forest inventory (CFI). The bias is demonstrated, and suggestions for correction are given.

Frayer, Warren E., and George M. Furnival.

1967. **Area change estimates from sampling with partial replacement.** Forest Sci. 13: 72-76.

Presents a method of calculating changes in area attributes on remeasured plots. Methods are shown whereby the estimates of change can be applied to results of a previous inventory and combined with the results of a current inventory to form final estimates of current parameters. An example is shown based on data taken from the most recent forest survey of vermont.

Gansner, David A.

1967. **Consumption of residues rises to an all-time high.** Ohio Woodlands 5(4): 14.

Use of sawmill residues by the wood-using pulpmills of the Central States has risen sharply in recent years. In 1964 the mills used 258,000 tons of residues, 42 percent more than in 1963. Residues accounted for 20 percent of Central States mill consumption in 1964.

Kingsley, Neal P.

1967. **Pulpwood production in the Northeast, 1964.** U. S. Forest Serv. Resource Bull. NE-5, 27 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The second in an annual series of reports on pulpwood production in the12 Northeastern States, containing data by counties for round pulpwood production and data by states for woodchip and other wood-industry byproducts. Compares 1963 and 1964 production. Also contains data on total receipts from outside the 12-state region.

Kingsley, Neal P., and David R. Dickson.
1967. **Pulpwood production in the northeast, 1965.** U. S. Forest Serv. Resource Bull. NE-6, 36 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A report on the third annual canvass of pulpwood production in the Northeast. This report contains data on Ohio and Kentucky in addition to the 12 states covered in the preceding reports. Data on round pulpwood production by state, county, and species groups; and pulpwood chip and residue production. a discussion of pulpwood production as it relates to the forest resource and an explanation of conversion factors used in these reports. Also a list of active woodpulp mills in the Northeast.

Manthy, R. S.
1967. **Dynamic concepts of timber requirements and availability.** S. Ind. Forest Manage. Conf. Proc. 7: 38-46. Duke Univ.

Timber resource, supply, and demand are not physically identifiable things. Rather they are dynamic functions of the timber, labor, and capital resources that go into the production process, and of the social, technological, and economic factors that constrain the availability of these resources. A dynamic projection model of timber supply and demand would provide a better basis for describing the nature of future supply problems and determining where and why these problems will occur.

Manthy, R. S., Lemmien, W. A., Rudolph, V. J., and James, L. M.
1967. **A time study for plantation logging.** Mich. State Univ. Agr. Exp. Sta. Quart. Bull. 49(3):328-341.

Time study data are used to compare the labor costs of two stem-selection logging methods commonly used to harvest pulpwood in thinnings of red pine plantations. Logging methods compared are a conventional 2-man boltwood operation and a 2-man tree-length logging operation. Labor costs for the boltwood operation were found to be significantly lower than for the tree-length method.

Marty, Robert, and George R. Trimble, Jr.
1967. **Planning for timber tract development.** U. S. Forest Serv. Res. Paper NE-64, 15 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Timber tracts, when first placed under management, frequently lack well-balanced growing stock of adequate quality, and they need roads. Forest managers normally seek to remedy these deficiencies during an initial period of tract development, leading toward a more stable and satisfactory production of timber. The development problem is discussed both from a theoretical and practical standpoint, and a case study is presented of development planning on a 600-acre mountain-hardwood timber tract in West Virginia.

Mendel, Joseph J.

1967. **Forestry accomplishments in southeastern Ohio under the U. S. Agricultural Conservation Program, 1957-64.** U. S. Forest Serv. Res. Paper NE-65, 26 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Defines the gap between the accomplishments of the forestry-practices portion of the U. S. Agricultural Conservation Program in southeastern Ohio and the estimated need for accomplishment by 1975, as indicated in the Conservation Needs Inventory. Charts the rather erratic annual accomplishments and emphasizes the need for close stewardship of the program to maintain the required progress.

Peters, Robert C., and Robert W. Wilson Jr.

1967. **The northeastern forest-inventory data-processing system. III. Operation of subsystem edit.** U. S. Forest Serv. Res. Paper NE-71, 31 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Subsystem EDIT is a computer program designed to facilitate the editing of large numbers of unit records. This report tells how to use the program. After a brief description of the applications of the program, a detailed description is given of the program control cards, together with a description of the organization of all input data and other information about actual processing.

Peters, Robert C., and Robert W. Wilson Jr.

1967. **The northeastern forest-inventory data-processing system. IV. Information for programmers subsystem edit.** U. S. Forest Serv. Res. Paper NE-72, 9 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Describes the salient features of the FORTRAN IV computer program designed to facilitate editing of large numbers of unit records. It gives the program limitations, describes the built-in program modification features, and summarizes the computer hardware requirements for its use.

Peters, Robert C., and Robert W. Wilson Jr.

1967. **The northeastern forest-inventory data-processing system. VI. Operation of subsystem table.** U. S. Forest Serv. Res. Paper NE-74, 25 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Subsystem TABLE is a computer program designed to reduce inventory data to any kind of tabular summaries required. This report tells how the program is used. After a brief description of its applications, a detailed description of the program control card formats is given, together with a description of the organization of all input data, and other information concerned with the actual processing.

Peters, Robert C., and Robert W. Wilson Jr.
1967. **The northeastern forest-inventory data-processing system. VII. Information for programmers subsystem table.** U. S. Forest Serv. Res. Paper NE-75, 22 pp. NE. Forest Exp. Sta., Upper Darby, Pa.
Describes the main features of the FORTRAN IV computer program that is the operative component of subsystem TABLE, gives the program limitations, describes the built-in modification features, and summarizes the computer hardware requirements.

Peters, Robert C., and Robert W. Wilson Jr.
1967. **The northeastern forest-inventory data-processing system. IX. Operation of subsystem output.** U. S. Forest Serv. Res. Paper NE-77, 18 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Subsystem OUTPUT is a computer program to be used in tandem with subsystem TABLE to print tables of population statistics and appropriate sampling errors. This report describes the use of the program. After a brief discussion of its applications in relation to subsystem TABLE, the formats of the program control cards are described, together with a description of the organization of all input data and other information needed for actual processing.

Peters, Robert C., and Robert W. Wilson Jr.
1967. **The northeastern forest-inventory data-processing system. X. Information for programmers subsystem output.** U. S. Forest Serv. Res. Paper NE-78, 15 pp. NE. Forest Exp. Sta., Upper Darby, Pa.
Gives the principal features of the FORTRAN IV computer program subsystem OUTPUT. Describes the program limitations, the built-in modification features, and the computer hardware requirements.

Quigley, Kenneth L., and Ronald D. Lindmark.
1967. **A look at black walnut timber resources and industries.** U. S. Forest Serv. Resource Bull. NE-4, 28 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Shows that current annual cut of all grades of walnut timber is slightly less than the growth accruing annually on commercial forest land. However, the annual cut of high-quality material exceeds the annual growth by almost 50 percent. The outlook for high-quality walnut timber in sufficient quantity to supply the current and increasing demand is not promising. Both growth and cut in future years must inevitably be lower until new management efforts begin to show results.

Wilson, Robert W. Jr., and Robert C. Peters.
1967. **The northeastern forest-inventory data-processing system. I. Introduction.** U. S. Forest Serv. Res. Paper

NE-61, 20 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Presents a comprehensive solution to the general problem of processing large amounts of forest inventory data. After a brief discussion of the nature and requirements of the processing problem, the system and its principal subsystems—EDIT, TABLE, and OUTPUT—are described. The operative subsystems (FORTRAN IV computer programs) are designed for use with high-speed low-capacity computers such as the IBM 7094/7040 Direct Coupled System. The system accommodates variable format input records that may be edited, coded, augmented, and summarized in a completely flexible set of tables of population statistics, which are printed with appropriate sampling errors.

Wilson, Robert W. Jr., and Robert C. Peters.

1967. **The northeastern forest-inventory data-processing system. II. Description of subsystem edit.** U. S. Forest Serv. Res. Paper NE-70, 12 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Subsystem EDIT is a FORTRAN IV computer program that is designed to check, code, and augment data in an unsorted file of unit records. The program can also form simple summaries of selected information in specified sets of unit records. The specifications of a job are given in the form of a schedule of operations to be performed on each unit record, selected from a set of 11 that have been pre-programmed. The format of input records may be variable from one job to the next but must be constant within any one input file. Output consists of a file of correct, fully processed records, printed messages about unit record errors and processing accomplished, and the information summaries, if any.

Wilson, Robert W. Jr., and Robert C. Peters.

1967. **The northeastern forest-inventory data-processing system. V. Description of subsystem table.** U. S. Forest Serv. Res. Paper NE-73, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Subsystem TABLE is a FORTRAN IV computer program designed to reduce large amounts of inventory data to tabular summaries. The output for each data set processed is a magnetic tape file that contains all the means and variances of sampling-unit attributes needed to fill out a set of summary tables, with format and content chosen by the user. The files can be transmitted to another program (OUTPUT) for additional computation and final printing of the tables. Input consists of program control cards and ordered sets of unit records, all of the same format, that contain all the sampling unit data for each data set to be processed.

Wilson, Robert W. Jr., and Robert C. Peters.
1967. **The northeastern forest-inventory data-processing system. VIII. Description of subsystem output.** U. S. Forest Serv. Res. Paper NE-76, 7 pp., illus NE. Forest Exp. Sta., Upper Darby, Pa.

Subsystem OUTPUT is a FORTRAN IV computer program designed specifically (1) to accept magnetic tape files of sampling-unit attribute means and variances compiled in another program (TABLE) and (2) to convert them to printed tables of population statistics for those attributes, using weights and computational procedures appropriate to the method of sampling.

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# RECREATION

LaPage, Wilbur F.
1967. **Camper characteristics differ at public and commercial campgrounds in New England.** U. S. Forest Serv. Res. Note NE-59, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Early findings from a 5-year panel survey of New England campers' changing leisure habits are reported. A significant number of campers interviewed at four commercial campgrounds differed in their camping behavior from campers at four state park and national forest campgrounds. The most apparent differences are the higher degree of mobility and the larger dollar investment in camping equipment of the commercial campground visitors.

LaPage, Wilbur F.
1967. **Some observations on campground trampling and ground cover response.** U. S. Forest Serv. Res. Paper NE-68, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The intensity of recreational use in a campground does not produce a direct reduction in the density of plants making up the ground cover. At first the number of plant species present declines markedly, but remaining species temporarily thrive on the improved seedbed with reduced competition. Bluegrass, bentgrass, path rush, and clover were found to have good natural resistance to trampling.

LaPage, Wilbur F.
1967. **Successful private campgrounds:** A study of factors that influence the length and frequency of camper visits. U. S. Forest Serv. Res. Paper NE-58, 22 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Certain characteristics of campground visitors provide useful measures of a camping enterprise's potential for success. Among a sample of visitors at private campgrounds in New Hampshire, visit lengths, frequencies, and return-visit intentions were all influenced by major attributes of the campgrounds, the campground managers, and the campers themselves. Shorter and less frequent visits were found to occur at campgrounds that were small, new, had low investments, had no water for swimming, and where the campground owner was a camper himself.

LaPage, Wilbur F.

1967. **The successful campground formula.** Family Camping Area Manage. Conf. Proc.: 35-52. Illus. Cornell Univ., Ithaca, N. Y.

An analysis of factors that help to spell success for private family camping enterprises, based on a study of campers and campgrounds in New Hampshire. Emphasis is placed on the relationship between consumer satisfaction and enterprise success. Several direct and indirect ways of promoting camper satisfaction are presented and evaluated.

LaPage, Wilbur F.

1967. **Recreation research and public land management goals.** N. Y. Forester 24(3): 2-6 (Soc. Amer. Foresters, N. Y. Sect.)

Some relationships between management goals and applied research alternatives in forest recreation are explored in respect to the best investment of limited research skills and money. Problems of managing recreation-area plants and soils, of measuring recreation attendance, and of estimating future demand are discussed in relation to their implied management goals.

LaPage, Wilbur F.

1967. **Book review: Economics of outdoor recreation,** by Marion Clawson and Jack L. Knetsch (Johns Hopkins Press, Baltimore, 328 pp., 1966). Rural Sociol. 32(4): 478-479.

A critical review of the first definitive text on economics as applied to outdoor recreation decisions. The authors' concentration upon governmental problems in the field is criticized in light of the growing interest, and need for development guidelines, by private recreation developers. The book's otherwise exhaustive coverage strongly recommends it for students concerned with the underlying issues of outdoor recreation policy.

Shafer, Elwood L. Jr.

1967. **Forest aesthetics—a focal point in multiple-use management and research.** 14th IUFRO Congr. Papers 7, Sect. 26: 47-71, illus. Munich.

Discusses current status of forest aesthetics research and the factors that affect aesthetic preferences; suggests opportunities for integrating timber management and forest aesthetics; summarizes the opinions of nine forest supervisors regarding aesthetic recovery rates following different cutting intensities; and proposes an experiment for measuring aesthetics of cut and uncut forest stands.

Shafer, Elwood L. Jr. and John F. Hamilton Jr.

1967. **A comparison of four survey techniques used in outdoor recreation research.** U. S. Forest Serv. Res. Paper NE-86, 22 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Handout questionnaires and mailed surveys—with three to four waves for nonrespondents—provided results that were comparable to personal-interview data in 75 to 87 percent of the question items. Delayed mail surveys conducted 3 months after the camping experience, and using questions of the same type or of similar complexity as those in the present study, are recommended over handout or immediately mailed surveys.

Shafer, Elwood L., Jr.

1967. **Some recent recreation research implications from the physical and biological sciences.** Parks and Recreation Congr. Proc. 1967: 35 pp. Miami, Fla.

How the physical and natural sciences affect research in scenic beauty, clear water, recreation equipment, and pure air. Explains why mathematics and computer systems form the nucleus of scientific recreation research, speculates on future research findings, and points to a need for better understanding between recreation management and research.

# WILDLIFE HABITAT

Jordan, James S.
1967. **Deer browsing in northern hardwoods after clearcutting. Effect on height, density, and stocking of regeneration of commercial species.** U. S. Forest Serv. Res. Paper NE-57, 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Heavy deer browsing can seriously reduce the height and density of commercial regeneration. These effects appear to be greatest in stems in the 3- to 5-foot height range. Where browsing is heavy, the density and stocking rates of stems above 3 feet in height may be a better indicator of the progress of stand establishment than if stems under 3 feet are included.

Jordan, James S.
1967. **Response to simulated deer browsing in selected hardwoods.** NE. Fish and Wildlife Conf. January 1964, Hartford, Conn. 13 pp., illus.

Reports the second-year survival, browse production, height, and form in seedlings of four species of commercial hardwoods clipped to simulate a full range of browsing intensities.

Jordan, James S.
1967. **Deer habitat research in Allegheny Plateau forests.** Pa. Federation of Sportsmen's Clubs. 6 pp.

Discusses the need to develop methods of habitat management that will yield the amount, quality, and distribution of deer food and other essential components of deer habitat for the maximum deer populations that can be efficiently harvested and that are compatible with the production of fine hardwoods—especially black cherry—from the forest resource.

Jordan, James S.
1967. **Nutritional aspects in deer browse management.** Proc. NE. Sec. Wildl. Soc. Annu. Conf., Quebec, Canada, 6 pp.

A system is proposed for gathering and analyzing information about deer food and deer nutrition for use in the management of habitat units for food production.

Jordan, James S., and Ward M. Sharp.
1967. **Seeding and planting hemlock for ruffed grouse cover.** U. S. Forest Serv. Res. Paper NE-83, 17 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Planting tests with hemlock under different aspects, stand types, and ground treatments in northern hardwoods showed that survival and height growth in 3-0 transplants were best on a north aspect in understocked, orchard-type hardwood

stands. Germination rates and first-year survival of germinates were low for all conditions tested, but there was a large increase in the density of germinates in the orchard type by the third year. Protection of seedlings against deer browsing is necessary where browsing pressure is high.

Pogge, Franz L.
1967. **Elm as deer browse.** J. Wildl. Manage. 31(2): 354-356.
Sprouts and tops of American elm were preferred woody deer browse on the Allegheny National Forest. More than 90 percent of the succulent sprouts and two-thirds of the twigs in the tops of trees felled in winter were utilized. These results are in general contrast to reports of low use of elm by deer.

# FOREST INSECTS

Amman, Gene D., and Robert L. Talerico.
1967. **Symptoms of infestation by the balsam woolly aphid displayed by Fraser fir and bracted balsam fir.** U. S. Forest Serv. Res. Note SE-85, 7 pp., illus. SE. Forest Exp. Sta., Asheville, N. C.
Stands of bracted balsam fir in Shenandoah National Park in Virginia and Fraser fir near Mt. Mitchell in North Carolina were examined to determine differences in symptoms. The principal injury to bracted balsam fir was gouting of nodes and buds. However, the trees survived several years of aphid infestation. Fraser fir was injured primarily by stem infestations by the aphid. Fraser fir trees died after a short period of aphid infestation.

Barger, J. H.
1967. **Shade tree selection and protection.** Trees Mag. 47(2): 13-15.
Two neglected approaches for protecting shade trees from insect damage are emphasized: (1) selecting a tree that fits a specific environment, and (2) protecting the tree with a knowledgeable and timely spray program. The life cycles of three shade tree pests were used to illustrate these two approaches.

Barger, J. H., and Ralph H. Davidson.
1967. **A life history study of the ash seed weevils** Thysanocnemis bischoffi **Blatchley and** Thysanocnemis helvola **Leconte.** Ohio J. Sci. 67(2): 123-127.
A life history study was made of the ash seed weevils **Thysanocnemis bischoffi** Blatchley and **T. helvola** LeConte. Overwintering occurs as larvae in ash seeds or in soil, and adults

appear in July and August. Adults soon deposit eggs within ash seeds, where larval development occurs. Only one generation per year was observed for each species.

Campbell, Robert W.

1967. **The analysis of numerical change in gypsy moth populations.** Forest Sci. Monogr. 15. 33 pp., illus.

A study of gypsy moth (**Porthetria dispar** (L.) ) population dynamics was carried out over a 7-year period in several areas in northeastern New York. The data were summarized in life tables, stratified by density and sex, and then analyzed by mathematical models. Variation in the survival rates of the instar IV to VI female larvae and the female pupae was the greatest source of variation in density among dense populations. Variation in the survival rates of both instar I to III and IV to VI female larvae was most important among sparse populations. A generation model was developed that describes density at the start of a second generation as a function of the environmental variables associated with mortality-causing factors.

Campbell, Robert W.

1967. **Studies on the sex ratio of the gypsy moth.** Forest Sci. 13: 19-22, illus.

The sex ratio among gypsy moth (**Porthetria dispar** (L.) ) embryos and newly hatched larvae approximated 50:50. By the time the insects reached instar II, however, the sex ratio had changed so that there were more female than male insects in the population. The sex ratio among both instar III and instar IV larvae continued to be distorted in favor of the females, and averaged about 66.34 at the start of instar IV. These findings complete the quantitative basis required for the explicit analysis of the female component of gypsy moth populations.

Campbell, Robert W.

1967. **Measuring age specific mortality factors of the gypsy moth.** Entomol. Soc. Amer. N. Cent. Br. Proc.: 53-56.

Discusses methods for estimating each of three different sorts of mortality factors of gypsy moth: mortality caused by ichneumonids among dense populations of pupae; predation by vertebrates among sparse populations of instar IV through VI larvae and pupae; and the components of disease among dense populations of the large larvae.

Donley, David E.

1967. **Distribution of Bidrin in the foliage of treated trees.** J. Econ. Entomol. 60: 1583-1585.

A 4-year study was made of the distribution patterns of Bidrin[R] (3-hydroxy-**N**-**N**-dimethyl-**cis**-crotonamide dimethyl phosphate) and/or its metabolites in the foliage of trees treated by

different methods. Leaf samples were taken from various sectors of the tree crown and were used for bioassays with **Daphnia pulex** DeGeer. Distribution patterns were significantly better after root implants than after trunk implants.

Donley, D. E., and D. P. Burns.
1967. **The foraging behavior of the honeydew-seeking ant,** Dolichoderus taschenbergi **Mayr.** Bull. Ecol Soc. Amer. 48(2): 65-66.

The ant **Dolichoderus taschenbergi** Mayr nests in old fields, and its foraging behavior reflects the availability of its primary food source, honeydew. The availability of food varies with time because of population fluctuations of the honeydew-producing insects. The tuliptree scale **Toumeyella liriodendri** (Gmel.) provides the only summer-long source of honeydew. Each year foraging patterns are re-established. First the worker ants wander around until they locate food sources; then the wandering pattern gives way to foraging via trails that persist as long as honeydew is produced.

Galford, Jimmy R.
1967. **A technique for rearing larvae of the smaller European elm bark beetle on an artificial medium.** J. Econ Entomol. 60: 1192.

Newly hatched larvae were placed in 100 mm. discs of medium, after excess moisture had been squeezed out with a laboratory press; and the discs were sealed between 4-inch-squares of plate glass. "Normal" adults emerged about 4 weeks later. The formula and preparation procedures for the medium are given.

Galford, Jimmy R.
1967. **Emergence of** Entedon leucogramma **from smaller European elm bark beetle larvae reared on artificial media.** J. Econ. Entomol. 60: 1482-1483.

Eulophid and bark beetle adults were recovered from the artificial medium. This medium had been infested with beetle larvae hatched from eggs dissected from infested wood. A live parasite larva was found in a dead beetle adult and each dead larvae.

Gibson, Lester P.
1967. **Stridulatory mechanisms and sound production in** Conotrachelus **(Coleoptera: Curculionidae).** Ann. Entomol. Soc. Amer. 60: 43-54.

The elytral stridulitra and the plectra on the sixth abdominal tergite are described and illustrated for both sexes of **Conotrachelus naso** LeConte, **C. posticatus** Boheman, and **C. carinifer** Casey, as is the stridulitrum of the male **C. nenuphar** (Herbst). The female of **C. nenuphar** has no plectrum. Demonstrable differences exist between the stridulations of these species, and between the sexes of each.

Godwin, P. A., and T. M. O'Dell.

1967. **Experimental hybridization of** Pissodes strobi **and** P. approximatus **(Coleoptera: Curculionidae).** Ann. Entomol. Soc. Amer. 60: 55-58, illus.

Reciprocal matings of **Pissodes strobi** (Peck) collected from white pine terminals and **Pissodes approximatus** Hopkins collected from red pine logs were made in the laboratory. No absolute reproductive isolating mechanisms were found, but there was greater mortality in the pre-hatch stages of the hybrids. Many anatomical features were measured to provide a basis for the identification of hybrids among natural populations.

Heller, R. C., J. H. Lowe, Jr., R. C. Aldrich, and F. P. Weber.

1967. **A test with large scale aerial photographs to sample balsam woolly aphid damage in the Northeast.** J. Forestry 65: 10-18.

The balsam woolly aphid (**Chermes Piceae** Ratz.) has caused an undetermined amount of mortality, tree deformation, and stand deterioration of balsam fir (**Abies balsamea** (L.) Mill) in the northeastern United States and the Maritime Provinces of Canada. A sampling technique to detect and estimate this damage by photo interpretation of large-scale color transparencies is described. Several scales (1: 796 to 1: 3960) and camera angles were tried before establishing 1: 1188 vertical scale at best.

Holt, W. R., B. H. Kennedy, and J. W. Peacock.

1967. **Formulae for estimating sample size for chi-square test.** J. Econ. Entomol. 60: 286-288.

Three formulae for chi-square are given that can be used to estimate the size of the sample needed when preliminary data are available or theoretical considerations are recognized. A fourth formula can be used when a proportion is hypothesized and a desired level of precision is specified.

Lincoln, A. Charles.

1967. **The status of systemic insecticides for shade tree insect control. 16th mid-winter.** Nat. Arborists Ass. Proc. 1967: 48-55.

Arborists were made aware of new avenues for the control of shade tree insects that heretofore have been either impractical or impossible. The properties of systemic insecticides were discussed from a practical viewpoint and the advantages and disadvantages of foliar, stem, and root introductions summarized. The article included references to a complete bibliography of recommended systemic insecticide control recommendations.

Lowe, R. E., R. L. Giese, and M. L. McManus.
1967. **Mycetangia of the ambrosia beetle,** Monarthrum fasciatum **(Coleoptera: Scolytidae).** J. Invert. Pathol. 9(4): 451-458.

Female beetles of **Monarthrum fasciatum** contain paired sac-like mycetangia in the anterior ventral prothorax. These large specialized organs for storage and transport of the ambrosia fungus spores are apparently lined with sclerotized cuticular material and the posterior portion is heavily musculatured. A tube extends from each mycetangium to an external opening in the procoxal cavity. One section of the organ wall adjacent to the tube lacks sclerotization and contains a series of cells and ducts that terminate in pores within the mycetangia. These may be secretory cells that provide the matrix surrounding the spore aggregates.

MacCollom, G. B., and H. W. Yawney.
1967. **Destruction of sugar maple seeds by the anthomyiid** Hylemya florilega. J. Econ. Entomol. 60: 296-297, illus.

The larvae of an anthomyiid **(Hylemya florilega Zih.)** known to cause widespread damage among horticultural crops was found to have destroyed as much as 70 percent of spring-sown sugar maple seed. However, this problem has occurred in only 1 year to date, and the overall importance of the insect in nursery production of sugar maple seedlings is as yet unknown.

McManus, M. L. and R. L. Giese.
1967. **The Columbian timber beetle,** Corthylus columbianus **(Coleoptera: Scolytidae). VI. Description of damage in sycamore.** J. Econ. Entomol. 60: 410-412.

Artifacts of the Columbian timber beetle, **Corthylus columbianus** Hopkins, are described from sycamore. Living tree hosts are attacked, which allows dating of historical presence. A southwestern Indiana stand reflected an outbreak of this beetle in 1956. Typical artifacts had 3 galleries, a mean of 15.7 egg cradles per artifact, a reddish associated stain, and a large necrotic area at the entrance hole. Although the general configuration of the artifacts in sycamore was similar to those in red and silver maple, a major difference was the higher egg cradle population in sycamore.

Peacock, John W., Bruce H. Kennedy, and Frank W. Fisk.
1967. **A bioassay technique for elm bark beetle feeding stimulants.** Ann. Entomol. Soc. Amer. 60: 480-481, illus.

A bioassay technique has been developed whereby host and non-host plant parts and extracts can be evaluated as possible feeding stimulants or deterrents for the smaller European elm bark beetle. **Scolytus multistriatus** (Marsham). A beetle-rearing technique utilizing paper cartons as rearing containers is described.

Rauschenberger, J. L., and R. L. Talerico.

1967. **Egg parasitism of the fall cankerworm.** J. Econ. Entomol. 60: 881-882.

To accurately predict potential larval populations and subsequent defoliation from egg surveys, it is necessary to have information about the incidence of egg parasitism. A study of fall cankerworm egg populations revealed just one parasite, the scelionid **Telenomus alsophilae** Vier. The life history of this parasite, with special reference to its synchronization with developmental stages of the fall cankerworm, is presented. Parasitized eggs of the cankerworm could not be distinguished by color differences from healthy eggs; dissection or rearing of host material is required to estimate the degree of parasitism.

Rexrode, C. O.

1967. **Preliminary study on the time and frequency of oak bark beetle attacks on oak wilt trees.** U. S. Dep. Agr. Plant Dis Rep. 51: 755-757.

Eleven percent of the inoculated trees sustained light bark beetle attacks in the branches, whereas 36 percent of the girdled trees suffered from light to heavy attacks on both the branches and boles. The number of girdled and inoculated trees successfully attacked differed significantly. The time of successful attacks on girdled and inoculated trees differed significantly, also.

Talerico, Robert L., Charles W. McComb, and Wallace T. Garrett.

1967. **Fiorinia externa Ferris, a scale insect of hemlock.** U. S. Dep. Agr. Forest Pest Leafl. 107, 4 pp., illus.

Briefly summarizes the life history of this pest and describes its life stages, geographic distribution, and effects on host trees. Some natural control agents are cited, and a method of control by systemic chemical insecticide is recommended.

# FOREST DISEASES

Berry, Frederick H.
1967. **Sweetgum diseases.** Univ. Mo. Tree Serv. Conf. 1966: 22-25.
Diseases affecting sweetgum (**Liquidambar styraciflua** L.) are discussed; and, where known, control measures are suggested.

Dochinger, Leon S.
1967. **Chlorotic dwarf of white pine, a problem of air pollution.** Ohio Woodlands 5(4): 18-19, illus.
Explains the symptoms and cause of the chlorotic dwarf disease of eastern white pine (**Pinus strobus** L.), and recommends control measures.

Dochinger, Leon S.
1967. **Leptographium root decline of eastern white pine.** (Abstr.) Phytopathol. 57: 809.
Symptoms of an unexplained dying of eastern white pine (**Pinus strobus**) that has occurred sporadically since 1957 in 3- to 15-year-old plantations in Indiana, Kentucky, Maryland, Ohio, Pennsylvania, and West Virginia are characterized. Trees succumb from a cambial necrosis of the roots that progressively girdles the root collar. A **Leptographium** species was consistently isolated from infected trees and its pathogenicity was established on healthy white pines.

Dochinger, Leon S.
1967. **Occurrence of poplar cankers caused by** Fusarium solani **in Iowa.** U. S. Dep. Agr. Plant Dis. Rep. 51: 900-903, illus.
A canker disease of eastern cottonwood and hybrid poplar trees in Iowa was found to be caused by **Fusarium solani.** This fungus should be considered a potential menace to hardwoods, particularly in plantations.

Houston, David R.
1967. **The dieback and decline of northeastern hardwoods.** Trees Mag. 28(1): 12-14, illus.
Discusses the symptomatology, causes, and occurrences peculiar to the dieback-decline diseases and suggests that the approaches to study and control of these diseases must necessarily differ from those used for disease caused by primary pathogens.

Jensen, Keith F.
1967. **Oxygen and carbon dioxide affect the growth of wood-decaying fungi.** Forest Sci. 13: 384-389, illus.
Dry weight production of four wood-decaying organisms was

measured in liquid cultures under oxygen concentrations from 0 to 40 percent and carbon dioxide concentrations from 0 to 30 percent. In general, dry weight production decreased with a decrease in oxygen concentration below atmospheric levels and with an increase in carbon dioxide concentration from zero percent. Since low levels of oxygen and high levels of carbon dioxide can occur in tree trunks, these gases may influence the activity of wood-decaying organisms in living trees.

Jensen, Keith F.

1967. **Measuring oxygen and carbon dioxide in red oak trees.** U. S. Forest Serv. Res. Note NE-74, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A method is described for collecting gas samples from tree trunks by placing a permanent probe in the tree and withdrawing samples with a portable vacuum pump. Marked quantitative differences were found between the concentration of gases in tree trunks and the concentration of gases in the atmosphere.

Jensen, Keith F., and Gordon E. Gatherum.

1967. **Height growth of Scotch pine seedlings in relation to pre-chilling, photoperiod and provenance.** Iowa State J. Sci. 41: 425-432, illus.

Height growth of Scotch pine seedlings was determined in relation to photoperiods of 12, 16, and 20 hours; pre-chilling periods of 0, 2, 4, 6, 8, and 10 weeks; and three provenances —Austria, Germany, and Turkey. Height growth increased with an increase of photoperiod and with an increase in the pre-chilling period and was greatest in the central European provenances. The effect of pre-chilling on height growth appeared to be interrelated with growing temperature and photoperiod.

Mazzone, H. M.

1967. **Equilibrium centrifugation. In Methods in virology:** 41-91 Academic Press, New York.

A review article describing the utilization of equilibrium centrifugation in virus research. From an analysis of the equilibrium pattern one can determine the molecular weight of the material of interest and ascertain the degree of heterogeneity in the sample. Macromolecules that can be studied by this method, in addition to viruses, include viral components such as nucleic acid, protein, and subunits. Among the topics reviewed are the recent advances in theory and experimentation, and the rapid processing of data through the use of computers.

Schreiber, Lawrence R., and Dochinger, Leon S.

1967. **Fusarium canker on paper mulberry** (Broussonetia papyrifera). U. S. Dep. Agr. Plant Dis. Rep. 51: 531-532, illus.

Fusarium canker on paper mulberry is a potentially serious disease because of the damage to this tree species and the danger of its spread to other susceptible hardwood trees. Our study demonstrated that inducing dormancy following inoculation or water stress prior to inoculation predisposes mulberry trees to increased susceptibility.

Shigo, Alex L.
1967. **The early stages of discoloration and decay in living hardwoods in northeastern United States: a consideration of wound-initiated discoloration and heartwood.** 14th IUFRO Congr. Papers 9 Sect. 41: 118-133. Munich.

A hypothesis about the development of discoloration and decay in living trees. In the early stages of these processes tissues altered as a result of discoloration processes are similar in some ways to tissues altered as a result of heartwood processes. Some differences between these processes are discussed.

Shigo, Alex L.
1967. **Successions of organisms in discoloration and decay of wood.** Int. Rev. Forest Res. 2: 237-299. Academic Press, New York.

A review of the literature relating to successions of organisms and the processes leading to discoloration and decay of wood.

# FOREST PRODUCTS UTILIZATION, MARKETING, AND ENGINEERING

Carpenter, Roswell D.
1967. **Major defects in southern hardwood veneer logs and bolts.** S. Lumberman 214(2668): 18, 20, 22, 24, 26, illus.

Summarizes the knowledge to date about log defects and how they effect yields from southern hardwood veneer logs and bolts. Presents information about "trunk lesion", a recently discovered serious defect in sweetgum and tupelo.

Carpenter, Roswell D.
1967. **Making better grade lumber from your hardwood logs —Part II.** Nat. Hardwood Lumber Ass. Yearbook, 1967: 147, 148, 150, 152, 154, 156, 158.

Discusses the problems of making the best grade sawlogs from hardwood trees, covering the problems and techniques of sawing hardwood logs to produce the best grades of lumber.

Cuppett, Donald G.

1967. **Orientation.** Ky. Governor's Conf. on Forestry Proc. 4: 1-3.

Introduces the theme of the 1967 Conference—"Effective Marketing of Kentucky's Forest Products"—and discusses three general principles important for successful marketing of all primary forest products: searching for and studying all potential markets, providing services to attract customers for repeat sales, and advertising both services and products.

Dempsey, Gilbert P.

1967. **Forest cooperatives: a bibliography.** U. S. Forest Serv. Res. Paper NE-82, 53 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Selected references to recent literature about the economics of cooperatives, including history of forest-based cooperatives, evaluation of marketing and management cooperatives, small woodland marketing research, and marketing rough forest products and primary manufactures.

Eads, L. D.

1967. **Furniture species: a forecast of tomorrow's trends.** Forest Prod. J. 17(8): 10-11.

This article presents the major factors that influence the selection of species for furniture manufacture, predicts future wood use in furniture manufacture, and discusses the impact of competing materials.

Eads, Larry D.

1967. **Furniture species—yesterday, today, and tomorrow.** Upholstering Ind. 34(4): 8, 10, 39, 40, 43, 45-49, illus.

Decreases historical use of wood in furniture manufacture and the major factors that influence wood use in furniture. Makes several predictions of future wood use and considers the impact of competing materials.

Ellefson, Paul V.

1967. **Christmas tree marketing: a bibliography.** Amer. Christmas Tree J. 11(2): 15-25.

A listing of Christmas tree marketing information recently published in the United States and Canada. Six major categories of information are included: (1) industry, (2) production, (3) management practices, (4) consumption, (5) research, and (6) bibliographies.

Ellefson, Paul, and Harold W. Wisdom.

1967. **Present costs determine future Christmas tree profits.** Amer. Christmas Tree J. 11(2): 9-13, illus.

Presents a method by which Christmas tree growers may estimate the potential returns from their plantation, discusses the factors that affect costs of growing Christmas trees, and by example outlines the steps required for determining a break-even price to which a margin for profit may be added.

Gatchell, Charles J.

1967. **A way to reduce highway guardrail costs: machine-driving of wooden posts.** U. S. Forest Serv. Res. Paper NE-81, 19 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Trials of a recently developed post-driving machine on a variety of sites along a West Virginia highway demonstrated that wooden posts can be installed at rates competitive with driven steel posts and at less cost. Installation rates of 28 to 30 posts per hour were obtained. On one difficult site, where steel posts could not be driven nor could an auger be used, wooden posts were driven at rates of 15 to 17 posts per hour.

Gatchell, Charles J.

1967. **Machine driving pressure-treated wood posts: a way to reduce highway guardrail costs.** Wood Preserving News. 45(8): 13-15.

Trials of a recently developed post-driving machine on a variety of sites along a West Virginia Highway demonstrated that pressure-treated wooden posts can be installed at rates competitive with driven steel posts, and at less cost. Installation rates of 28 to 30 posts per hour were obtained. On one difficult site, where steel could not be driven nor could an auger be used, wooden posts were driven at rates of 15 to 17 posts per hour.

Gibson, Harry G., Donald L. Gochenour, Jr., Robert L. Hartman, and and Homer W. Parker.

1967. **Wheeled skidder performance in steep terrain.** NE. Forest Exp. Sta., Upper Darby, Pa. 26 pp., illus.

Report on a talk presented to the American Society of Agricultural Engineers. Wheeled skidder performance on steep terrain was measured under a controlled experimental design. Performance rates were determined for moderate and steep slopes. Winching capabilities of the machines were determined.

Hajny, G. J., R. N. Jorgensen, and J. J. Ferrigan.

1967. **Outside storage of hardwood chips in the Northeast. I. Physical and chemical effects.** TAPPI 50(2): 92-96.

Outside storage results in chemical changes that cause a rise in temperature and a discoloration of the chips. In a chip pile of northeastern hardwoods, loss of wood substance amounted to about 6 percent after 6 months of storage. Discoloration of chips and loss of pulp yield were apparent after only 1 month of storage in the chip pile.

Herrick, Owen W.

1967. **A look at Kentucky's lumber industry.** U. S. Forest Serv. Res. Paper NE-63, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Describes the structure and operation of Kentucky's lumber

industry, based on data from a 1962 statewide timber-utilization survey. The influence of sawmill size and geographic location are analyzed to explain differences in operating and marketing practices.

Herrick, Owen W., and W. W. Christensen.
1967. **A cost analysis of chip manufacture at hardwood sawmills.** U. S. Forest Serv. Res. Paper NE-69, 14 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
A study of the cost of converting hardwood residues to pulp chips at seven selected sawmills in the western Appalachian region. Emphasis is placed on identifying all factors that determine the change in total net cost to the sawmill firm as a result of producing chips.

Lucas, John T.
1967. **Wooden pallet requirements by Department of Defense.** S. Lumberman 214(2665): 13-16.
Describes the Department of Defense (DOD) pallet requirements and purchasing procedures. Wooden pallet requirements of the DOD more than tripled from 1965 to 1966, yet only a small percentage of the pallet producers sold to the DOD because few producers are acquainted with DOD purchasing procedures and pallet requirements.

Martens, David G.
1967. **How lumber price changes affect sawlog values.** U. S. Forest Serv. Res. Paper NE-89, 38 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Report on a 10-year study of the changes in hardwood lumber prices in relation to their effect on the Applachian hardwood sawmill industry. In general, the fluctuations in prices for hardwood lumber in the Appalachian Region have resulted in only a slight increase in the value of hardwood sawlogs produced during the past decade.

McCauley, Orris D., and James C. Whittaker.
1967. **The value added by sawmilling in the Appalachian hill country of Ohio and Kentucky.** U. S. Forest Serv. Res. Note NE-67, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
The difference between log costs and lumber values at 40 sawmills in the Appalachian hill country of Ohio and Kentucky provides an estimate of the value added by sawmill production. Based on these estimates, sawmilling contributed about $12.8 million to the region's economy in 1962.

McCauley, Orris D., and James C. Whittaker.
1967. **Sawmill practices and problems in the Appalachian hill country of Ohio and Kentucky.** U. S. Forest Serv. Res. Paper NE-80, 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Based on a study of 40 commercial sawmills in the forested hill country of Ohio and Kentucky, this report describes the mill types, their production practices, and their productivity, and attempts to identify the general problems related to milling efficiency. These problems are production delays—especially equipment failure—limited mechanization, poor record-keeping, lack of standardization in log-grading systems used, and poor working conditions.

Martens, David G., and E. Paul Craft.
1967. **The marcraft floor-leveling system for urban rehabilitation.** U. S. Forest Serv. Res. Note NE-66, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A speedy and efficient system has been developed for installing wooden screeds that can be used as a base for laying a level new floor over an old sagging floor. The screeds are held in position by means of a new leveling device, and rigid urethane foam is sprayed under the screeds to hold them permanently in a level position.

Parker, Homer W., Harry G. Gibson, and Ross A. Phillips.
1967. **Wheeled skidder experiments in Appalachia.** 14th IUFRO Congr. Papers 8 Sect. 31-32: 364-384. Munich.

Discusses the production obtained by the use of wheeled skidders in the Appalachian mountains and describes a controlled experiment using three different machines. Defines maximum operable slopes and the forces necessary to move Appalachian hardwood tree-length logs. Improvements are needed in winches and in some other features of machines for operation on steep terrain.

Schroeder, James G., and Leland F. Hanks.
1967. **Lumber grade-yields for factory-grade northern red oak sawlogs. U. S. Forest Serv. Res. Note NE-65,** 7 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A report on results of sawing 556 northern red oak sawlogs at four sawmills in West Virginia and Virginia, and the distribution of grades for the standard factory lumber produced. Tabular data on actual yield and curved grade-yield percentages.